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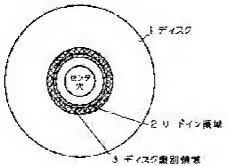
(71)Applicant : MATSUSHITA ELECTRIC IND CO LTD
(72)Inventor : AOKI YOSHITO
OHARA SHUNJI
ISHIDA TAKASHI
KONISHI SHINICHI
SHOJI MAMORU
KUMON YUJI
MIYAHATA YOSHIYUKI
DEGUCHI HIRONORI

(54) OPTICAL DISK WITH ILLEGAL COPY PREVENTING FUNCTION AND OPTICAL DISK DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To discriminate whether a disk is an illegally copied disk by utilizing the presence/absence of a prepit section not located on the center line of a track or the presence/absence of the rocking of the track.
SOLUTION: In a partial area of a disk 1, a displaced pit string 7 in which a part of pit strings of a track 5 is displaced in the radial direction is arranged. When a light spot is passed through the displaced pit string 7, the amplitude variation of a reproducing signal is little but a large level variation is generated in a tracking error signal. By utilizing the level variation of the tracking error signal, the presence/absence of the displaced pit string 7 is detected and the disk is discriminated. In a partial area of a disk 51, a track 54 oscillated with higher frequency than the frequency at the



intersection of the control gain of tracking control is provided and the disk is discriminated by the level of a rocking frequency component included in the tracking error signal.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]In the optical disc in which record reproduction is possible, this invention relates to the optical disk unit which can distinguish whether they are an optical disc which has shape peculiar to a disk in an information pit sequence, and the disk unjustly copied using information peculiar to the optical disc.
[0002]
[Description of the Prior Art]Optical discs including a compact disk are used as an information transmission means in various fields, such as application software for personal computers in recent years, a database, music.
[0003]Since especially a read-only optical disc transfers an information pit from the master stamper of one sheet to a plastic sheet by injection molding and can manufacture a disk, there is the feature which can produce the optical disc of an identical content in large quantities and cheaply in a short time.
[0004]Using figures, are and the tracking control method for reading information in an optical disc is explained. Drawing 25 is a block diagram of the conventional tracking control.
[0005]200 is a disk and it is a disk motor which 201 rotates a track, 202 rotates light spot, and 210 makes rotate the disk 200. 211 is an optical head which plays the signal on the disk 200 optically, and comprises a semiconductor laser of 212, a collimate lens of 213, an object lens of 214, a half mirror of 215, a light sensing portion of 216, and an actuator of 217. 220 is a tracking error signal primary detecting element which detects the tracking error signal which shows the amount of position shifts of the radial direction of the light spot 202 and the track 201, and comprises a differential circuit of 221, and a low-pass filter of 222. The phase compensation part which generates the driving signal which drives an optical head from a tracking error signal 223, and 224 are head actuators which drive the actuator 217 in the optical head 211 based on a driving signal. They are the binarization circuit unit in which, and 226 binary-izes a regenerative signal, and a signal processing part which 227 restores to a regenerative signal and changes into information data. [225] [the adder circuit of the signal from the light sensing portion 216]
[0006]First, although position control of the focus direction (focusing direction) of light spot is performed, a general target is premised on focus control being realized in this invention.
[0007]Below, the operation to which tracking control is carried out is explained. The laser beam irradiated from the semiconductor laser 212 is made into a parallel beam with the collimate lens 213, and it converges it on the disk 200 via the object lens 214. The laser beam reflected by the disk 200 is detected considering the luminous energy distribution which returns to the light sensing portions 216a and 216b via the half mirror 215, and is decided by the relative position of the light spot 202 on a disk, and the track 201 as an electrical signal. When the light sensing portions 216a

and 216b of 2 division are used, the differential circuit 221 detects the difference of 216a and 216b of a light sensing portion, and a tracking error signal is detected by taking out low-pass [of a differential signal] with the low-pass filter 222. In order to make the light spot 202 follow the track 201, A driving signal is generated in the phase compensation part 223 so that a tracking error signal may be set to 0 (the luminous energy distribution of the light sensing portions 116a and 116b is equal), according to the driving signal, the actuator 217 is moved by the head actuator 224, and the position of the object lens 214 is controlled.

[0008]On the other hand, if the light spot 202 follows the track 201, reflected light quantity decreases because light interferes, the output of a light sensing portion declines, and since reflected light quantity increases, in a portion without a pit, the output of a light sensing portion will become high at the pit section of a track. The total light volume of the light sensing portion output corresponding to this pit is calculated in the adder circuit 225, and a binary-ized signal and a read clock are generated for this regenerative signal in the binarization circuit unit 226. It can use now for this binary-ized signal as information by going via the signal processing part 227 which performs a recovery and an error correction.

[0009]Although the information read from the optical disc is transmitted to a personal computer etc. and it is used within a personal computer, a part or all of information can also carry out record-keeping to other archive media if needed. Generally, since it is protected by law, you cannot copy copyrights, such as application software for personal computers, without a right holder's consent. However, a copy prevention method which the information distributed by recordable media records copy management information on media for a certain reason, and also manages the case copied unjustly may be taken.

[0010]

[Problem(s) to be Solved by the Invention]However, in a read-only optical disc, since only playback of the information currently recorded can be performed, copy management information is not memorizable on the disk itself. Therefore, since the contents of the read-only optical disc are unauthorized, are copied to the media in which other cheap records are possible and are used for them, a technical problem occurs in respect of copyright protection.

[0011]In view of the aforementioned problem, this invention is adding identification information as shape of a track, and an object of this invention is to prevent reuse of the information on a copy disk on the original copy disk regularly distributed under a right holder's management.

[0012]

[Means for Solving the Problem]In order to solve the above-mentioned problem, an illicit copy prevention optical disc of this invention provided a displacement pit sequence which displaced radially some tracks which comprised an information pit sequence from a track center line in some radius fields of an optical disc.

[0013]Position information in which said displacement pit sequence exists in a disk which has said displacement pit sequence, and displacement pattern information of said displacement pit sequence are recorded on said information pit sequence.

[0014]It has the rocking track region which made a track which comprised an information pit sequence rock with predetermined frequency and predetermined amplitude, and formed it, and position information or information on rocking frequency that said rocking track exists is recorded on said information pit sequence.

[0015]An optical disk unit with an illicit copy preventing function of this invention, An optical disc which has said displacement pit sequence, and a displacement pit sequence primary detecting element which detects existence of said displacement pit sequence from level fluctuation of a tracking error signal, A locating position information primary detecting element and the displacement pit column information Management Department which read and memorize locating position information and displacement pattern information of said displacement pit sequence, It had

a disk judgment part which discriminates that existence and a displacement pattern of a displacement pit sequence are in agreement from an output from said displacement pit sequence primary detecting element and a displacement pattern coincidence detection part.
[0016]An optical disc which has said rocking track and a rocking track primary detecting element which extracts a rocking ingredient from a tracking error signal, It had a locating position information primary detecting element and a rocking frequency information primary detecting element which read and memorize locating position information and rocking frequency information that a rocking track exists, and a disk judgment part which discriminates a disk from an output of said rocking track primary detecting element.
[0017]
[Function]By the above-mentioned composition, this invention is forming peculiar track form as a recognition signal for every optical disc, identifies whether the disk which it is going to play is an original disk, and can restrict use of the data based on an illicit copy disk.
[0018]
[Example]Hereafter, the optical disc with an illicit copy preventing function of the 1st example of this invention is explained, referring to drawings.
[0019]The schematic diagram of the optical disc with an illicit copy preventing function in the 1st example of this invention is shown in drawing 1. In drawing 1 (a), 1 is a disk and is a disk identification region with [2 / the lead-in groove field of the disk] a displacement pit sequence in 3. Drawing 1 (b) is an enlarged drawing in a disk identification region, and a displacement pit sequence and 8 are light spot the track for which 4 was formed as a pit sequence a pit and 5, the main pit sequence for which the pit was formed in the track center 6, and 7.
[0020]Operation is explained using drawing 1. In the master stamper manufacturing process for disk manufacture, the track 5 is formed by cutting (exposure) using laser as a series of pit sequences by a predetermined abnormal-conditions rule. During cutting of this track 5, the displacement pit sequence 7 is formed by cutting, where the laser beam for cutting is displaced temporarily [radial direction / track] by a position. The amount of displacement of the track radial direction of this displacement pit sequence 7 is a range which does not have big influence on the regenerative signal of the information expressed by the pit, and displacement of a pit sequence gives a quantity detectable as level fluctuation of a tracking error signal.
[0021]Generally amplitude change deltaRF of regenerative-signal RF to amount of position shifts deltax of the pit 4 and the light spot 8 becomes like drawing 2 (a), and, on the other hand, amplitude change deltaTE of tracking error signal TE to amount of position shifts deltax of the pit 4 and the light spot 8 becomes like drawing 2 (b). Compared with amplitude change deltaTE of a tracking error signal, amplitude change deltaRF of a regenerative signal to amount of position shifts deltax Namely, since it is small, If it is in the state of the suitable amount of position shifts (the amount of displacement of a pit), the amplitude change of a regenerative signal is a range which does not affect reproduction of information, and it is possible to detect the level fluctuation of a tracking error signal certainly.
[0022]Usually, what is necessary is just to set the amount of displacement which can detect level fluctuation as a suitable quantity of a track pitch which is about 1 / 15 to 1/8 in general, if it takes into consideration that the accuracy required of tracking control is about [of track pitch TP] 1/15.
[0023]Since a tracking error signal passes LPF (Low Pass Filter), in order to detect it as level fluctuation of the signal after LPF passage, usually, It is necessary to make the length of the track line direction of a displacement pit sequence into the length in the LPF signal band (about 50 kHz or less) of a tracking error signal. therefore, the track line direction length of the displacement pit sequence 7 -- as the pass time of the light spot 8 -- tens -- what is necessary is just to make it become more than microsec
[0024]The waveform of regenerative-signal RF in the above-mentioned displacement pit sequence

7 and tracking error signal TE is shown in drawing 3. When the light spot 8 is in the main pit sequence 9, since there is the light spot 8 at the center of the track 5 mostly by tracking control, tracking error signal TE shows about zero value. Regenerative-signal RF serves as a signal according to the existence of the pit 4.

[0025]Next, when the light spot 8 starts the displacement pit sequence 7 of amount of displacement deltax, since the light spot 8 cannot follow the displaced pit sequence steeply, position shift deltax arises in the light spot 8 and the pit 4, and, only in delta TE, the level of tracking error signal TE changes suddenly. Regenerative-signal RF does not influence reproduction, either, although only delta RF is changed.

[0026]the pass time of the displacement pit sequence 7 -- tens -- in being about microsec, before the light spot 8 follows the displacement pit sequence 7, in order to return to the usual main pit sequence 10, a tracking error signal returns to about zero again like drawing 3. Therefore, tracking error signal TE before and behind the displacement pit row part 7 serves as a waveform as shown in drawing 3.

[0027]therefore -- if the displacement pit sequence is provided in the original disk -- **** -- the level fluctuation of a tracking error signal arises in a displacement pit row part like. On the other hand, when copying the information in an original disk to other archive media, it is possible to copy the information acquired from a regenerative signal, but since a displacement pit sequence is not copied, an original copy disk or a copy disk can be identified by the existence of a displacement pit sequence.

[0028]If the disk identification region 3 which arranges this displacement pit sequence is used together with the management data field (for example, TOC area of CD) of the disk certainly played at the time of a disk reproduction operation start and it enables it to certainly check it at the time of disk starting, it is efficient.

[0029]Next, the 2nd example is described. Drawing 4 is a schematic diagram of the displacement pit sequence in the 2nd example, and shows the case where the displacement direction of a displacement pit sequence is combined by a regular pattern. In drawing 4, the main pit sequence which comprised a pit where a pit and 5 have 8 in a track, it is in light spot, and 4 has 11, 12, and 13 in a track center, and 14 and 15 are the discernment pit sections which comprised a displacement pit sequence and a displacement pit sequence of plurality [16]. Here, the case where it has arranged the two displacement pit sequences 14 and 15 at a time to one disk periphery and inner circumference side, respectively is described.

[0030]The arrangement area of the amount of displacement of each displacement pit sequences 14 and 15 and length, and a displacement pit sequence is the same as that of the 1st example. If the light spot 8 shall pass displacement pit sequence ID114 by the side of a periphery first and then shall pass displacement pit sequence ID215 by the side of inner circumference like drawing 4, the level fluctuation of a tracking error signal will arise in a displacement pit sequence as the 1st example explained, but. Since the direction of this level fluctuation changes with the displacement directions of a pit, it is set to tracking error signal TE changed to the negative side a right side in the position of a displacement pit sequence like drawing 4, respectively.

[0031]Therefore, it becomes possible to identify the pattern of a displacement pit sequence according to the state of the level fluctuation of a tracking error signal. It becomes possible to separate certainly the level fluctuation of the tracking error signal generated with the crack of a disk, dirt, etc., and the level fluctuation of the tracking error signal by a displacement pit sequence with constituting a pattern, using a displacement pit sequence two or more. 1 set of discernment pit sections 16 constituted combining such two or more displacement pit sequences can form arbitrary patterns by combining arbitrarily the displacement direction of each displacement pit sequence, and the number. For example, when using the two displacement pit sequences ID1 and ID2 in a group, (ID1, ID2) can choose four displacement patterns, (inner circumference, inner

circumference), (inner circumference and a periphery), (a periphery and inner circumference), and (a periphery and a periphery), in the combination of a displacement direction. The length of the main pit sequence 12 between the displacement pit sequence 14 and the displacement pit sequence 15 may be shorter than the displacement pit sequences 14 and 15, and is also omissible.

[0032]Next, the 3rd example is described. Drawing 5 shows the arrangement information of the displacement pit sequence in the 3rd example. The management data field for which a disk records 31, the lead-in groove field of the disk was recorded 32, and disk management data was recorded 33, and 34 are displacement pit arrangement tracks with which the displacement pit has been arranged. As for the disk management data of the contents of the disk, etc., and 37, 35 is [the locating position information on a displacement pit sequence and 39] the displacement pattern information of a displacement pit sequence displacement pit information and 38 the management data of a disk, and 36. 40 is a track and 41 is a displacement pit sequence or a discernment pit sequence.

[0033]Although this example explains the case where locating position information and displacement pattern information are recorded as displacement pit information, When only locating position information or displacement pattern information is recorded, supposing only the information on a locating position or a displacement pattern is effective, it can realize without losing generality. What is necessary is just to record the information on the direction which is not specified to a standard on the disk, when the locating position or the displacement pattern is especially decided as a disk standard. Since it is preferred to record on some data of the management data field which records the contents of the disk, etc. as for this displacement pit information, explain as what displacement pit column information is recorded on the management data field 33 of the disk, but. It is satisfactory even if it arranges displacement pit column information in addition to a management data field.

[0034]First, in the usual management data field, wherever it may repeat and record the block of the management data of the same contents and an optical head may be in [in a management data field], management data can be read. The displacement pit information 37 other than the disk management data in which the contents and the position of a disk are shown is recorded on the management data 35. The displacement pit information 37 comprises the displacement pattern information 39 of a displacement pit sequence (a displacement pattern, the number, etc.), when it constitutes a discernment pit section, the locating position information 38 which shows the track position (or address number) where the displacement pit sequence is arranged, and.

[0035]And the discernment pit section 41 which comprises combination of the displacement pit sequence shown in a displacement pit sequence or the displacement pattern information 39 is formed in the track 40 shown in locating position information.

[0036]In the displacement pit arrangement track 34 shown using the locating position information on displacement pit information, the displacement pit sequence (discernment pit section) 41 is arranged to two or more places like drawing 5 (c). Although the number of the displacement pit sequences (discernment pit section) 41 may be one, since the portion may read by a disk defect etc. and may become impossible, this is because it is better to have arranged two or more displacement pit sequences (discernment pit section) 41 on the same track.

[0037]One track may be sufficient as it, and even if it crosses the displacement pit arrangement track 34 to the range about a number track, it is satisfactory on operation.

[0038]If it is made like [the 2nd example], since it is not necessary to record a displacement pit sequence on a large field and and a disk maker can specify arbitrary displacement patterns as arbitrary positions compared with the 1st example, it will become possible to give code nature to discernment of a disk.

[0039]Next, the 4th example is described. Drawing 6 is a lineblock diagram of the disk with an illicit copy preventing function of the 4th example. It is an entire disk figure, 51 is a disk, and drawing 6 (a)

is the disk identification region which comprised a track of the pit sequence which rocked 52 in the lead-in groove field of the disk, was made to rock 53 on regular frequency, and was formed. Drawing 6 (b) is an enlarged drawing of the disk identification region 53, and is the rocking track with which constitute 4 from a pit, 8 comprised light spot, and 54 comprised a pit sequence.

[0040]Since the light spot 8 cannot follow rocking of the rocking track 54 if the rocking frequency fwb of the rocking track 54 of drawing 6 (b) is set as frequency higher than the zone (gain crossover frequency) of tracking control, the oscillation amplitude A becomes the amount of position shifts. Therefore, the fluctuating signal of rocking frequency is ****(ed) by the tracking error signal.

[0041]What is necessary is for below the zone of LPF of a tracking error signal primary detecting element to carry out a rocking ingredient, and just to set it as the range of 1 kHz - 20 kHz about, in order to detect as a level variation of a tracking error signal. The oscillation amplitude A is set as 1 of track pitch TP / about 15 to 1/8 suitable quantity, as the 1st example described as amplitude of the grade which does not affect a regenerative signal.

[0042]Regenerative-signal RF at this time and the situation of tracking error signal TE are shown in drawing 7. The light spot 8 follows near the amplitude center of the rocking track 54, and rocking of the rocking track 54 cannot be followed. Therefore, in tracking error signal TE, the signal level equivalent to the oscillation amplitude A occurs on the rocking frequency fwb. Although amplitude fluctuation arises also in regenerative-signal RF, it is a level which does not influence reproduction.

[0043]By detecting the signal level of the specific frequency fwb of the tracking error signal produced with this rocking track 54, discernment of an original copy disk or a copy disk can be performed.

[0044]If this rocking track is used together with the management data field (for example, TOC area of CD) of the disk certainly played at the time of a disk reproduction operation start like the 1st example and it enables it to certainly check it at the time of disk starting, it is efficient.

[0045]Next, the 5th example is described. Drawing 8 shows the arrangement information of the rocking track in the 5th example. The management data field for which a disk records 61, the lead-in groove field of the disk was recorded 62, and disk management data was recorded 63, and 64 are tracks with which the rocking track has been arranged. As for the disk management data of the contents of the disk, etc., and 67, 65 is [the locating position information on a rocking track and 69] the rocking frequency information on a rocking track rocking track information and 68 the management data of a disk, and 66.

[0046]Although this example explains the case where locating position information and rocking frequency information are recorded as rocking track information, When only locating position information or rocking frequency information is recorded, supposing only the information on a locating position or rocking frequency is effective, it can realize without losing generality. What is necessary is just to memorize on the disk the information which is not specified to a standard, when the locating position or the displacement pattern is especially decided as a standard of a disk. Since it is preferred to record on some data of the management data field which records the contents of the disk, etc. as for this rocking track information, explain as what rocking track information is recorded on the management data field 63 of the disk, but. It is satisfactory even if it arranges rocking track information in addition to a management data field.

[0047]First, in the usual management data field, as mentioned above in Example 4, the management data 65 is arranged repeatedly, and the rocking track information 67 other than the disk management data 66 is recorded in each management data 65. The rocking track information 67 records the locating position information 68 and the rocking frequency information 69 that the rocking track is arranged.

[0048]The track number (or address number) in which the rocking track 64 exists is recorded on the locating position information 68 in the management data field 63. The forming-rocking track 64 rocking frequency fwb is recorded on the rocking frequency information 69.

[0049]The rocking track 64 shown using the locating position information 68 on a rocking track makes the pit sequence rock with the frequency and the predetermined amplitude which were shown using the rocking frequency information 69. Although one track may be sufficient as a rocking track and it may be formed succeeding a multiple track, it is not necessary to make it a not much large field.

[0050]By making it the disk configuration shown in the 5th example, since it is not necessary to establish a rocking track in a large field and and a disk maker can specify a rocking track as arbitrary positions on arbitrary frequency, it becomes possible to give code nature to disk discernment.

[0051]Next, the 6th example is described. Drawing 9 is a schematic diagram of the optical disk unit with an illicit copy disk identifying function of the 6th example. As for the optical disc with an illicit copy preventing function which stated 1 in the 1st example or the 4th example, the track with which the pit on the disk 1 and 5 are constituted for 4 as a pit sequence, and 7, in drawing 9, a displacement pit sequence and 8 are light spot. The optical head in which 70 is a disk motor made to rotate the disk 1, and 71 plays the pit signal on the disk 1 optically, The tracking error signal primary detecting element which detects tracking error signal TE by which 72 is equivalent to the amount of radial direction position gaps of the light spot 8 and the track 5, The differential circuit where 73 takes the differential of the regenerative signal from the optical head 71, the low pass filter in which 74 removes the high-frequency component of a tracking error signal, The phase compensation part in which 75 generates a head driving control signal from a tracking error signal, The head actuator in which 76 drives an optical head, the adder circuit where 77 generates a regenerative signal from an optical head, The binarization circuit unit in which 78 performs binary-izing of a regenerative signal, and synchronizing detection of data, the signal processing part which 79 restores to a regenerative signal and reads information, The displacement pit sequence primary detecting element where 80 detects a displacement pit row part from a tracking error signal, and 81 and 82 are the voltage comparators which constitute the displacement pit sequence primary detecting element 80, and it is a disk judgment part from which 98 performs an OR circuit and 92 discriminates a disk.

[0052]In the optical disk unit constituted as mentioned above, an operation method is explained using drawing 9 and 10. The optical disc which has a displacement pit sequence of the 1st example here is explained to an example.

[0053]The operation to which tracking control to which the disk 1 rotates and the light spot 8 follows the track 5 top here is carried out is the same as that of the method described by the conventional example. The process in which the course and tracking error signal which read information from a regenerative signal are generated is the same as a conventional example.

[0054]Drawing 10 is a principle-of-operation figure of the displacement pit sequence primary detecting element 80 which detects the displacement pit sequence 7 from a tracking error signal.

[0055]When a displacement pit sequence is displaced to the periphery side to a track center line top and it is displaced to the (a) and inner circumference side, it has (b). When the light spot 8 passes the displacement pit sequence 7, since a position shift arises in the light spot 8 and the displacement pit sequence 7 as Example 1 already described, rapid level fluctuation arises in a tracking error signal, and it becomes like drawing 10. The direction of level fluctuation of tracking error signal TE at this time changes with displacement directions of the displacement pit sequence 7. Here, in drawing 10 (a), it shall change to a right side, and shall change to a negative side in drawing 10 (b). So, existence of the displacement pit sequence 7 is detectable in the displacement pit sequence primary detecting element 80 by comparing the slice level beforehand set to the fluctuation level of this tracking error signal TE at the time of displacement pit sequence passage. Here, in order to detect displacement of an outer peripheral direction and to detect displacement of the slice level REF (+) and the direction of inner circumference, the slice level REF (-) is set up, and

the voltage comparators 81 and 82 in the displacement pit sequence primary detecting element 80 compare a level with tracking error signal TE. As a result, synchronizing with the outer peripheral direction displacement pit sequence 7, DET (-) is detected synchronizing with the direction displacement pit sequence 7 of DET(+) inner circumference, and existence of a displacement pit sequence is detected. DET (+) and DET (-) are inputted into the disk judgment part 92 as an IDDET signal which shows whether a displacement pit sequence exists by OR circuit 98.

[0056]By the disk judgment part 92, when DET (+) and DET (-) are not detected (IDDET=L), it is recognized as a displacement pit sequence not existing, and it is judged here that it is not an original disk. On the other hand, when one of DET (+) and the DET(s) (-) is detected (IDDET=H), it is judged that it is an original disk.

[0057]Although the displacement pit sequence primary detecting element 80 is the composition of detecting the level of tracking error signal TE, in drawing 9 and 10, it is also possible to detect the sudden level fluctuation of tracking error signal TE by a differentiation circuit like drawing 11. In drawing 11, 95 is 96 and a differentiation circuit and 97 are voltage comparators. When tracking error signal TE lets the differentiation circuit 95 pass, a waveform like a TED signal is acquired. This TED signal detects whether it exceeded with the slice level REF2 (-) to the right side at the negative side to DET2 (+) and DET2 (-) with the slice level REF2 (+). That is, existence of the displacement pit sequence 7 is also discriminable by whether DET2 (+) or DET2 (-) are detected.

[0058]Since the level fluctuation by rocking arises at a tracking error signal also in the case of the optical disc in which a disk has a rocking track of the 4th example, When this level fluctuation exceeds the slice level REF (+) and REF (-), DET (+) and DET (-) are outputted in the displacement pit sequence primary detecting element 80. Therefore, what is necessary is just to identify a disk by the existence of the output of DET (+) and DET (-) by the disk judgment part 92.

[0059]Next, the 7th example is described. Drawing 12 is a lineblock diagram of the optical disk unit with an illicit copy disk identifying function in the 7th example. In drawing 12, the optical disc with an illicit copy preventing function which stated 1 in the 2nd example, and 4 are the pits on the disk 1, and it is displacement pit sequence ID1 and displacement pit sequence ID2 which have been arranged by the track with which 5 is constituted as a pit sequence, and 8 having 14, and light spot and 15 having a displacement pattern. Here, it explains taking the case of the case where the pattern of a displacement pit sequence is identified using two displacement pit sequences. 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, and 92 are the same as that of the 6th example, and the pattern coincidence detection part 83 which judges whether the pattern of a displacement pit sequence newly agrees with a fixed pattern was formed in the 7th example.

[0060]In the optical disk unit constituted as mentioned above, an operation method is explained using drawing 12 and 13.

[0061]Here, two displacement pit sequence ID114 and ID215 drawing 13, respectively The periphery side displacement pit sequence, In the bottom constituted as an inner circumference side displacement pit sequence, the case is shown, tracking error signal TE produces level fluctuation in the portion of each displacement pit sequence as above-mentioned, the TE level fluctuation is detected and DET (+) and DET (-) are outputted in the displacement pit sequence primary detecting element 80. Since the identification condition of this disk is that DET (+) and DET (-) are detected by a fixed pattern, in this example, DET (+) will be detected first and then DET (-) should just be detected. So, in the pattern coincidence detection part 83, when the output pattern of DET (+) and DET (-) decided beforehand and the pattern of DET (+) and DET (-) actually outputted from a displacement pit sequence primary detecting element are in agreement, the coincidence signal IDDET is outputted. Namely, what is necessary is just to judge that a disk is an original copy disk, when the coincidence signal IDDET is outputted. This judgment is made by the disk judgment part 92.

[0062]Next, the 8th example is described. Drawing 14 is a schematic diagram of the optical disk unit

with an illicit copy disk identifying function of the 8th example. In drawing 14, the optical disc with an illicit copy preventing function which stated 51 in the 4th example, and 4 are a pit on the disk 51, and the rocking track with which 54 comprised a pit sequence which rocked radially with predetermined frequency and amplitude. As for 85, the amplitude measurement section of a rocking track and 87 are the magnitude comparison parts of oscillation amplitude a rocking track primary detecting element and 86.

[0063]Here, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, and 92 carry out same operation with the same composition as Example 6.

[0064]In the optical disk unit constituted as mentioned above, an operation method is explained using drawing 14, and 15 and 16.

[0065]Drawing 15 shows the principle of operation which detects the rocking track 54 in the rocking track primary detecting element 85. Rocking twists on a track, by track 55, the light spot 8 is positioned on the center line of a track, and the tracking error signal usually serves as a value of the zero neighborhood in general. When the light spot 8 is on the rocking track 54, the light spot 8 cannot follow rocking of a track as mentioned above, but tracking error signal TE like drawing 15 is detected.It inputs into the amplitude measurement section 86 with the frequency characteristic which passes only the specific frequency (rocking frequency) fwb for this tracking error signal TE selectively like drawing 16. As a result, the output signal Awb of the amplitude measurement section 86 usually has small amplitude in track 55 field, and is outputted as amplitude fluctuation by rocking track 54. And when an Awb signal compared and exceeds whether the predetermined slice level REFwb was exceeded in the magnitude comparison part 87, it is made to output the detecting signal IDDET. Therefore, when IDDET is detected, a rocking track will exist, and it is judged that it is an original disk. This judgment is made by a disk judgment part.

[0066]The rocking track primary detecting element 85 can also realize composition like drawing 17 like drawing 14 besides the composition in the amplitude measurement section 86 and the magnitude comparison part 87. In drawing 17, the frequency characteristic test section in which 88 measures frequency spectra, and 89 are amplitude analysis parts which detect whether it is no with the frequency component exceeding reference level.

[0067]The situation of operation of this rocking track primary detecting element 90 is shown in drawing 18. The frequency characteristic test section 88 sets up a suitable measurement section, and measures the frequency spectra of tracking error signal TE within this section. In drawing 18, the case of the measurement section 56 in the track 55 and the measurement section 57 in the rocking track 54 is usually illustrated. the measurement sections 56 and 57 -- the signal component in each frequency is measured by each, and frequency spectra become as it is shown in a figure. Next, the amplitude analysis part 89 investigates how [that is the fixed oscillation amplitude frequency fwb] the frequency is, when it investigates whether the frequency component which exceeds reference amplitude REFwb2 among the amplitude of each called-for frequency component exists and there is amplitude to exceed. As a result, when frequency is fwb, it judges with there being a rocking track, and it outputs as detecting-signal IDDET=H (measurement section 57:00). However, when a perimeter wave number ingredient is smaller than reference amplitude REFwb2, or when the frequency of the frequency component exceeding REFwb2 is not in agreement with the rocking frequency fwb, it outputs as detecting-signal IDDET=L and it is shown that a rocking track does not exist (measurement section 58:00).

[0068]The existence of a rocking track can be judged with the output of the detecting signal IDDET by the above.

[0069]Next, the 9th example is described. Drawing 19 is a schematic diagram of the optical disk unit with an illicit copy disk identifying function of the 9th example. In drawing 19, 31 is the described optical disc in the 3rd example, and is the disk with which the displacement pit sequence 41 was formed in the position which the locating position information 38 on the disk management data 36

and a displacement pit sequence was recorded on the management data field 33, was in it, and was specified for the locating position information 36.

[0070]91 is a position information primary detecting element which reads locating position information, and 92 is a disk judgment part. 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, and 80 carry out same operation with the same composition as the 6th example.

[0071]Hereafter, operation is explained using drawing 19 and 20. Drawing 20 is a flow chart which shows operation of the 9th example. First, the management data field 31 of a disk is played at the time of playback of the disk 31 (s1). The disk management data 36 in which the contents and the position of the information currently recorded on the disk 31 are shown is recorded on this management data field 31.

At the time of a reproduction start, this management data is usually reproduced.

It is assumed that the locating position information 37 which shows the address position by which the displacement pit sequence has been arranged combines, and is recorded on the disk 31 in which the displacement pit sequence of this invention was formed by a part of this management data field 31. Then, the position information primary detecting element 91 reads and memorizes the data (IDADR) about the displacement pit sequence locating position information 37 out of the data reproduced (s2).

[0072]Next, the optical head 71 is moved to the address which IDADR shows (s3). It is investigated whether the displacement pit sequence 41 exists in this address position (s4). Since the detecting signal IDDET from the displacement pit sequence primary detecting element 80 is H when a displacement pit sequence exists, it is judged that it is an original copy disk at the time of IDDET=H (s5). On the other hand, if IDDET continues being L, it will be judged that the disk which it is going to play since it means that a displacement pit sequence does not exist is not an original disk (s6). The judgment of this disk is performed by the disk judgment part 92.

[0073]Although the 9th example described the disk 31 with the displacement pit sequence 41, also in the disk 61 which formed a rocking track like the 5th example in the specified position, a disk can be judged by same operation. In this case, in the position information primary detecting element 91, while playing the management data field 63 in the disk 61, the locating position information 68 by which the rocking track has been arranged is read.

[0074]What is necessary is just to judge whether it is an original disk by whether the rocking track primary detecting element 85 (or 90) which stated in the 8th example instead of the displacement pit sequence primary detecting element 88 is formed, and IDDET is set to H in the specified address position.

[0075]Next, the 10th example is described. Drawing 21 is a schematic diagram of the optical disk unit with an illicit copy disk identifying function of the 10th example. In drawing 21, 31 is the described optical disc in the 3rd example, and the displacement pattern information 39 of the disk management data 36 and a displacement pit sequence is recorded on the management data field 33, and it is in it, It is the disk with which the displacement pit sequence was formed in the decided track position 34 by the pattern shown by displacement pattern information.

[0076]93 is a displacement pattern information primary detecting element which reads displacement pattern information, and 83 is the same as that of the pattern coincidence detection part of Example 7. 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, and 92 carry out same operation with the same composition as the 6th example.

[0077]Hereafter, operation is explained using drawing 21 and 22. Drawing 22 is an operation flow chart of the 10th example. Operation is explained using drawing 21 and 22.

[0078]First, the management data field 33 is reproduced at the time of a disk reproduction start (s11). At this time, the displacement pattern information (IDPAT) 39 of the displacement pit sequence currently recorded on the part in the management data field 33 is read and memorized in the displacement pattern information primary detecting element 93 (s12). This displacement pattern

information (IDPAT) 39 is set up as a reference pattern which the pattern coincidence detection part 83 compares (s13). Next, it is investigated whether a displacement pit sequence exists in the track position 34 considered that a displacement pit sequence probably exists (s14). Since the output IDDET of the pattern coincidence detection part 83 will be set to H if it exists by the pattern in which the displacement pit sequence was decided, it is judged that it is an original disk (s15). If IDDET continues being L, it will mean that the specified displacement pit sequence does not exist, and it will be judged that it is not an original disk (s16). The disk judgment part 92 makes this judgment.

[0079]The locating position information on the displacement pit sequence of the 9th example and the displacement pattern information of the 10th example may be simultaneously used for a judgment. Namely, what is necessary is just to investigate whether the displacement pit sequence which displacement pattern information shows exists in the position which the locating position information on a displacement pit sequence shows.

[0080]Next, the 11th example is described. Drawing 23 is a schematic diagram of the optical disk unit with an illicit copy disk identifying function of the 11th example. In drawing 23, 61 is the optical disc described in the 5th example, and is the disk with which the rocking track 64 was formed on the rocking frequency which the rocking frequency information 69 on the disk management data 66 and a rocking track was recorded on the management data field 63, was in it, and was specified as rocking frequency information.

[0081]94 is a rocking frequency information primary detecting element which reads rocking frequency information, 85 is the rocking track primary detecting element which stated in the 8th example, and 92 is a disk judgment part.

[0082]70, 71, 72, 73, 74, 75, 76, 77, 78, and 79 carry out same operation with the same composition as the 6th example.

[0083]Operation is explained using drawing 23 and 24. Drawing 24 is an operation flow chart of the 11th example. First, the management data field 63 is reproduced at the time of a disk reproduction start (s21). At this time, the rocking frequency information (IDFWB) 69 currently recorded on the part in the management data field 63 is read and memorized in the rocking frequency information primary detecting element 94 (s22). This rocking frequency information (IDFWB) 69 is set up as reference frequency which the rocking track primary detecting element 85 compares (s23). next, it is investigated whether a rocking track exists in the track position where a rocking track exists and which is considered to come out (s24). Since the output IDDET of the rocking track primary detecting element 85 will be set to H if the rocking track 64 formed on the specified rocking frequency (IDFWB) exists, it is judged that it is an original disk (s25). If IDDET continues being L, it will mean that the specified rocking track does not exist and it will be judged that it is not an original disk (s26). The disk judgment part 92 makes this judgment.

[0084]In using the amplitude measurement section 86 for drawing 16 as composition of the rocking track primary detecting element 85, the passing frequency fwb uses a variable thing. What is necessary is just to compare the frequency specified by IDFWB in the amplitude analysis part 89, in using the frequency characteristic test section 88 of drawing 17.

[0085]The locating position information on the rocking track of the 9th example and the rocking frequency information on the 11th example may be simultaneously used for a judgment. Namely, what is necessary is just to investigate whether the track of the rocking frequency which rocking frequency information shows exists in the position which the locating position information on a rocking track shows.

[0086]

[Effect of the Invention]The displacement pit sequence which displaced radially only the quantity with little influence to regenerative-signal reading in which this invention is detectable on some tracks which comprise a pit sequence in the signal band of a tracking error signal from the track center line is provided in some disks as mentioned above, It enables it to identify existence of a

displacement pit sequence with the fluctuation level of the tracking error signal in that displacement pit row part, and discernment from the original copy disk which has this displacement pit sequence, and the copy disk which does not have a displacement pit sequence is enabled. Code nature can be further improved by recording the locating position information and displacement pattern information of the displacement pit sequence on some data as identification information peculiar to a disk, and identifying the existence of the displacement pit sequence of the specific pattern in the specific position of a displacement pit sequence.

[0087]The rocking track which is the specific frequency which cannot follow the track which comprises a pit sequence by tracking control, and made only amplitude with little influence to regenerative-signal reading rock radially is established in some disks, By judging the existence of a rocking track with the signal level of the specific rocking frequency component in a tracking error signal, discernment from the original copy disk which has this rocking track, and the copy disk which does not have a rocking track is enabled. The locating position information and frequency information on a rocking track are recorded on some data as identification information peculiar to a disk, a disk can be identified by investigating the signal level of the specific rocking frequency component in a specific position, and code nature can be improved more.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1](a) is a figure showing the whole optical disc of the 1st example.
(b) is the figure to which the disk identification region was expanded.
[Drawing 2]The figure showing the relation between the amount of position shifts, a regenerative signal, and a tracking error signal
[Drawing 3]The figure showing the response waveform in a displacement pit row part
[Drawing 4]The figure showing the displacement pit sequence of the 2nd example
[Drawing 5](a) is a figure showing the whole optical disc of the 3rd example.
(b) is a figure showing a management data field.
(c) is a figure showing a displacement pit arrangement track.
[Drawing 6](a) is a figure showing the whole optical disc of the 4th example.
(b) is the figure to which the disk identification region was expanded.
[Drawing 7]The wave form chart of the regenerative signal in a rocking track, and a tracking error signal
[Drawing 8](a) is a figure showing the whole optical disc of the 5th example.
(b) is a figure showing a management data field.
(c) is a figure showing a rocking track.
[Drawing 9]The block diagram of the optical disk unit of the 6th example
[Drawing 10]The figure showing the principle-of-operation figure of a displacement pit sequence primary detecting element
[Drawing 11](a) is a figure showing the detector circuit by a differentiation circuit.
(b) is a figure showing the detection principles by a differentiation circuit.
[Drawing 12]The block diagram of the optical disk unit of the 7th example
[Drawing 13]The figure showing the detection principles by the 7th example
[Drawing 14]The block diagram of the optical disk unit of the 8th example
[Drawing 15]The figure showing the principle of operation of a rocking track primary detecting element
[Drawing 16]The figure showing the frequency characteristic of an amplitude measurement section
[Drawing 17]The block diagram of the example 2 of realization of a rocking track primary detecting element
[Drawing 18]The figure showing the principle of operation in the example 2 of realization
[Drawing 19]The block diagram of the optical disk unit of the 9th example
[Drawing 20]The flow chart of the 9th example
[Drawing 21]The block diagram of the optical disk unit of the 10th example
[Drawing 22]The flow chart of the 10th example
[Drawing 23]The block diagram of the optical disk unit of the 11th example

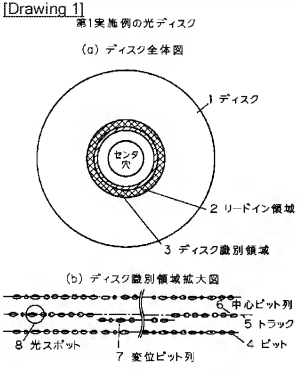
[Drawing 24]The flow chart of the 11th example
[Drawing 25]The block diagram showing the tracking control block of a conventional example
[Description of Notations]
1 Disk
2 Lead-in groove field
3 Disk identification region
4 Pit sequence
5 Track
6 A main pit sequence
7 Displacement pit sequence
8 Light spot
9, 10, 11, 12, and 13 Main pit sequence
14 Displacement pit sequence ID1
15 Displacement pit sequence ID2
16 Discernment pit section
31 Disk
32 Lead-in groove field
33 Management data field
34 Displacement pit arrangement track
35 Management data
36 Disk management data
37 Displacement pit information
38 Locating position information
39 Displacement pattern information
40 Track
41 A displacement pit sequence or a discernment pit section
42 Pit
51 Disk
52 Lead-in groove field
53 Disk identification region
54 Rocking track
55 Usually, a track
56 and 67 Measurement section
61 Disk
62 Lead-in groove field
63 Management data field
64 Rocking track
65 Management data
66 Disk management data
67 Rocking track information
68 Locating position information
69 Rocking frequency information
70 Disk motor
71 Optical head
72 Tracking error signal primary detecting element
73 Differential circuit
74 Low-pass filter
75 Phase compensation part
76 Head actuator

77 Adder circuit
78 Binarization circuit unit
79 Signal processing part
80 Displacement pit sequence primary detecting element
81 and 82 Voltage comparator
83 Pattern coincidence detection part
85 Rocking track primary detecting element
86 Amplitude measurement section
87 Magnitude comparison part
88 Frequency characteristic test section
89 Amplitude analysis part
90 Rocking track primary detecting element
91 Position information primary detecting element
92 Disk judgment part
93 Displacement pattern information primary detecting element
94 Rocking frequency information primary detecting element
95 Differentiation circuit
96 and 97 Voltage comparator
98 OR circuit
200 Disk
201 Track
202 Light spot
210 Disk motor
211 Optical head
212 Semiconductor laser
213 Collimate lens
214 Object lens
215 Half mirror
216a, a 216b light sensing portion
217 Actuator
220 Tracking error signal primary detecting element
221 Differential circuit
222 Low-pass filter
223 Phase compensation part
224 Head actuator
225 Adder circuit
226 Binarization circuit unit
227 Signal processing part

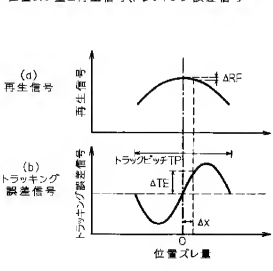
[Translation done.]

DRAWINGS

[Drawing 1]

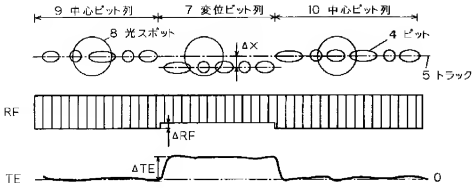


[Drawing 2]



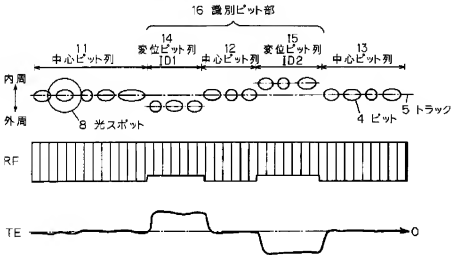
[Drawing 3]

変位ピット列部分での応答波形



[Drawing 4]

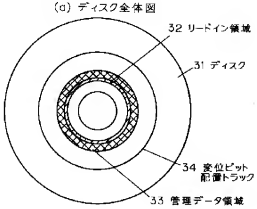
第2実施例の変位ピット列



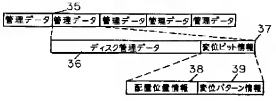
[Drawing 5]

第3実施例の光ディスク

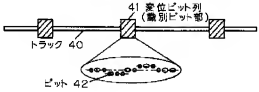
(a) ディスク全体図



(b) 管理データ領域



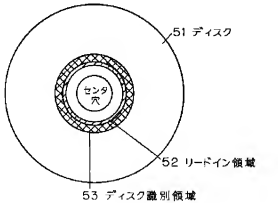
(c) 変位ビット配置トラック



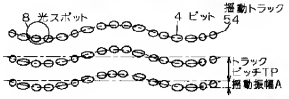
[Drawing 6]

第4実施例の光ディスク

(a) ディスク全体図

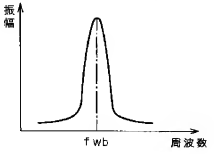


(b) ディスク識別領域拡大図



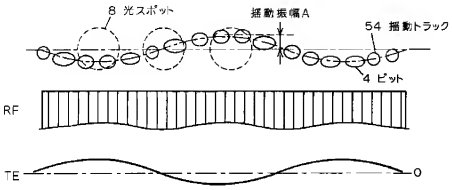
[Drawing 16]

振幅測定部の周波数特性



[Drawing 7]

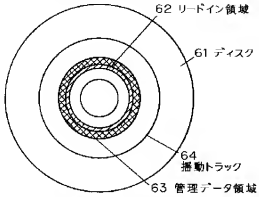
揺動トラックと再生信号、トラッキング誤差信号



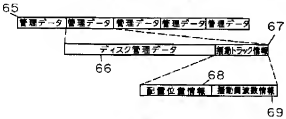
[Drawing 8]

第5実施例の光ディスク

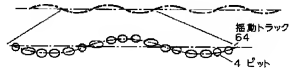
(a) ディスク全体図



(b) 管理データ領域



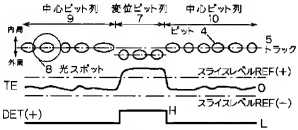
(c) 揺動トラック



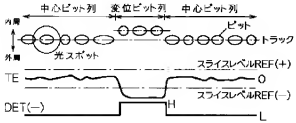
[Drawing 10]

変位ピット列検出部の動作原理図

(a) 外周側変位ピット列

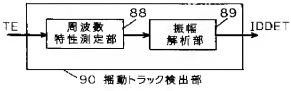


(b) 内周側変位ピット列



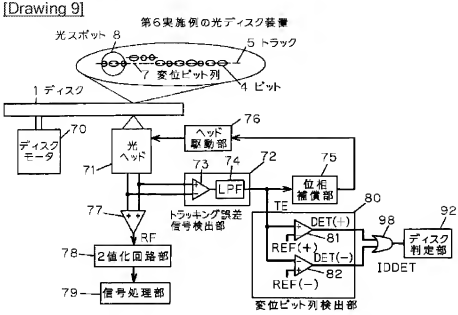
[Drawing 17]

摇動トラック検出部の実現例2



[Drawing 9]

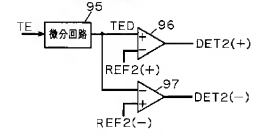
第6実施例の光ディスク装置



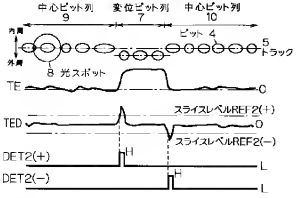
[Drawing 11]

変位ピット列検出部の原理(2)

(a) 微分回路による検出回路

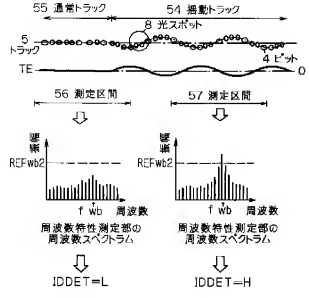


(b) 微分回路による検出原理



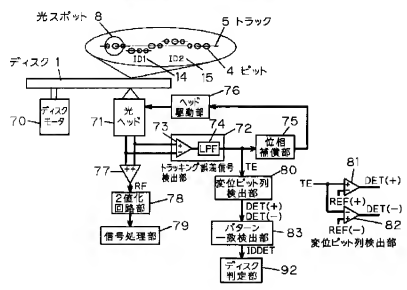
[Drawing 18]

実現例2での動作原理



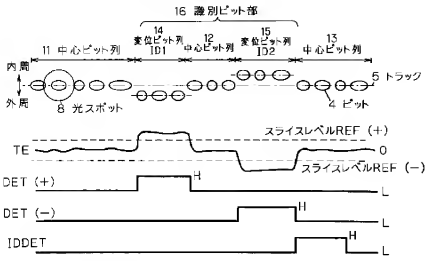
[Drawing 12]

第7実施例の光ディスク装置



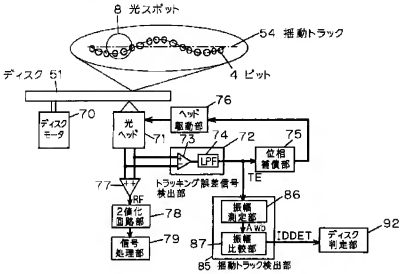
[Drawing 13]

第7実施例における検出原理



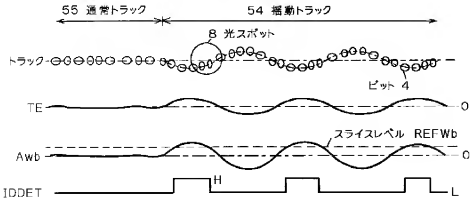
[Drawing 14]

第8実施例の光ディスク装置



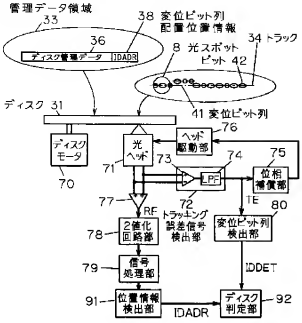
[Drawing 15]

揺動トラック検出部の動作原理



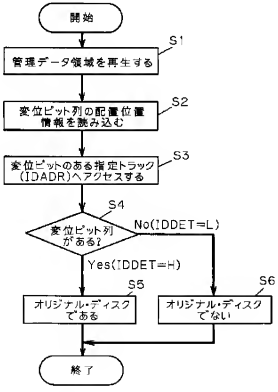
[Drawing 19]

第9実施例の光ディスク装置



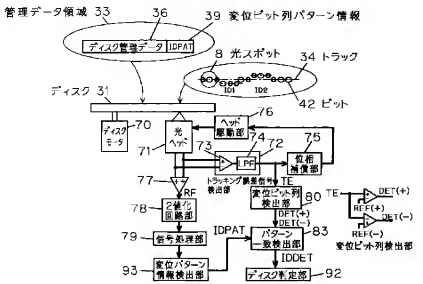
[Drawing 20]

第9実施例のフローチャート



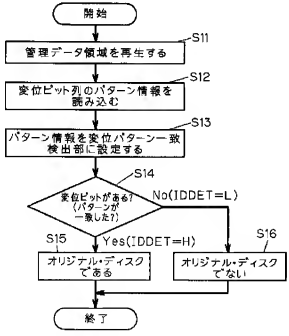
[Drawing 21]

第10実施例の光ディスク装置



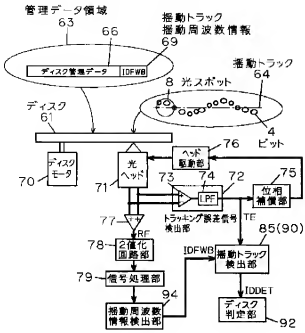
[Drawing 22]

第10実施例のフローチャート



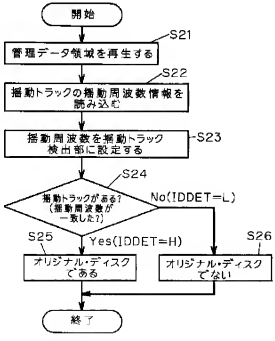
[Drawing 23]

第11実施例の光ディスク装置

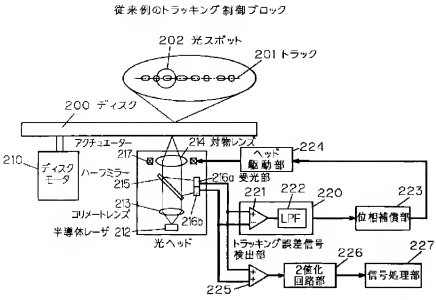


[Drawing 24]

第11実施例のフローチャート



[Drawing 25]



[Translation done.]